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JOURNAL OF OIL & FAT INDUSTRIES

The Official Organ of The American Oil Chemists' Society

Vol. III NOVEMBER, 1926 No. 11

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Journal of Oil and Fat Industries is a monthly publication published by Russell Palmer at 220 West 42nd St., New York, N. Y. Nov., 1926, Vol. III, No. 11. Subscription $3.00 the year, domestic; four dollars, foreign. Entered at the Post Office, N. Y., Dec. 31, 1925, as second class matter under act of March 3, 1879.

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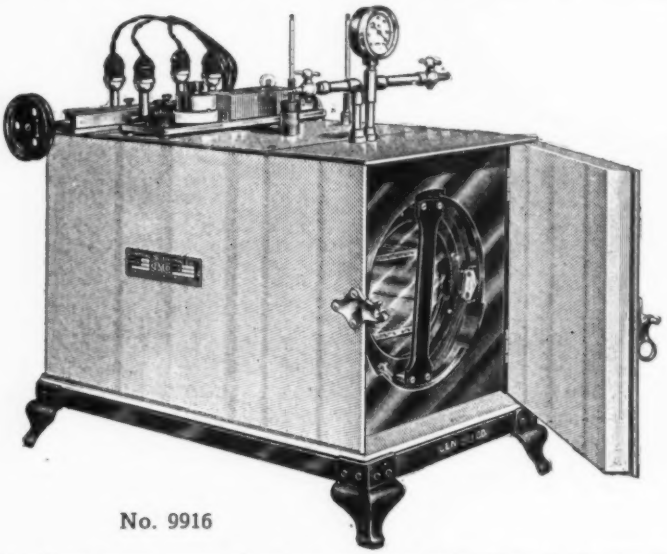

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VOL. III NOVEMBER, 1926 No. 11

EDITORIAL

REFINING CRUDE COTTONSEED OIL

An article which should be of great interest to oil chemists and refiners is published in this number on the refining test for crude Cottonseed Oil, giving some results of a scientific study of a very troublesome problem; one that has given a vast amount of trouble to the buyers and sellers of crude oil. Additional data is expected to be published later.

The first attempt to formulate a definite method for refining tests dates back to about 1900, when representatives of various large refining interests met in Chicago and agreed on a method of procedure. In those days secrecy was the watchword throughout the cotton oil industry, and therefore the details of the method then adopted were not published in full; but the Interstate rules stated that instructions in the method would be given to those needing same, by certain designated chemists.

Some years later a committee of the Society of Cotton Products Analysts (now the American Oil Chemists Society) wrote up a method for making these tests which was published in their official methods of analysis, substantially like the present official method.

The American Oil Chemists Society has always had a committee endeavoring to so improve details of this procedure as to result in more concordant results by different chemists, but without making much progress, owing to lack of opportunity and facilities for a sufficiently intensive study of the problem. Wide differences are still reported frequently by different referee and other chemists working on identical samples of crude.

When we compare the wonderfully close results in analyzing cottonseed meal, obtained these days by different chemists, with the status of this work twenty years ago, and remember that this improvement resulted solely from a careful, scientific study of the problem, it is hardly conceivable that a decided improvement cannot be made in refining tests if this problem also is attacked in a proper scientific manner. Refining tests now stand about where meal tests stood twenty years ago, as regards reliability and consistency. As far as we are aware, this is the first intensive effort to discover the causes of such troublesome differences in these analyses, and much good must ultimately come from work of this kind.

REFINING METHOD FOR CRUDE COTTONSEED OIL

The following is a progress report of work done for the Refining Committee, in the laboratory of the Procter & Gamble Company, since the last convention. The program undertaken consists of three parts.

First, a detailed study of each step in the operation, to determine the effect of variations in same.

Second, on the basis of the data from No. 1, a revised method to be written up involving all the optimum conditions and eliminating all chance for personal difference in procedure.

Third, a comparison of results obtainable with this revised method, in the hands of different operators, as compared with results by the present official method.

The first portion is sufficiently far advanced to present results at this time, and correspondence and suggestions are invited from all interested parties.

Two lots of well settled oil were set aside for this work, one containing approximately 4 per cent F.F.A. and the other about 20 per cent. The former will be referred to here as the "Low F.F.A. Oil" and the latter as the "High F.F.A. Oil." The procedure followed was substantially that of the present official method, varying only one condition at a time. In order to insure constant speed, the usual friction type drive was replaced with gears, and in order to maintain a standard rate of heating in all tests this was accomplished by transferring the dish after mixing in cold water bath directly into a hot water bath maintained at 60° to 65°C. In eight minutes, under these conditions, the low F.F.A. oil reached a temperature about 5° below the temperature of the bath and the high F.F.A. oil about 10° below the bath temperature. The greater amount of lye in the latter case made the heating somewhat slower.

The principal points studied so far, with results obtained, are as follows: all figures shown being checked by two or more tests; color readings over 50 RED were made on a short column and corrected to approximate a 5¼" column.

Paddles

Various sizes and shapes of paddles were first tried on various oils, noting color and loss obtained, and especially the time required to cause a visible mixing movement on the surface of the mixture in case of high F.F.A. oils. Some average results are shown below:

Size and Form of Paddle	Average Results on Four Oils			
	F. F. A.	Color	Loss	Time to Mix
½" Straight Paddle	15.3%	65 R	44.0%	10 minutes
½" Twisted Paddle	15.3	71	44.1	12+ "
1" Straight Paddle	15.3	61	42.2	1 minute
1" Twisted Paddle	15.3	61	43.2	7 "

The 1 inch paddle, especially on high F.F.A. oils, appeared so much

superior to the present ½ inch paddle, especially in time required for mixing, that it was adopted for all subsequent work. The straight form is definitely superior to the twisted form.

The effect of varying the distance of the paddle above the bottom of the dish, up to a 1 inch clearance, was found to be negligible.

Refining Vessel

A comparison was made of a wide and shallow dish vs. a deep and narrow dish, as it was felt that on bad oils the large amount of foots formed might settle more completely and could be drained more thoroughly if in a shallow layer instead of a deep layer. No difference in results, however, could be found.

Rate of Agitation Cold

R. P. M.	Low F. F. A. Oil Color	Loss	High F. F. A. Oil Color	Loss
100	9.5 R	11.4%	—	—
150	8.9	11.4	255 R	52.3%
200	8.9	11.7	220	54.2
250	8.9	11.7	210	50.5

On the basis of the above results, a speed of 250 R.P.M. was adopted. Higher speeds could not be used safely with the 1 inch paddle.

Time for Agitating Cold

Time	Low F. F. A. Oil Color	Loss	Time	High F. F. A. Oil Color	Loss
3 minutes	9.7 R	10.0%	3 Min.	230 R	51.2%
12 "	9.4	12.3	10 "	220	52.1
21 "	9.3	12.8	16 "	180	55.5
30 "	9.3	13.9	20 "	180	54.9
			30 "	180	58.0

It is obvious that the loss increased steadily with the time of agitating. Color does not improve proportionately on these oils after about 10 to 15 minutes. Consequently, 10 minutes was adopted for subsequent work.

Temperature of Agitating Cold

Temp.	Low F. F. A. Oil Color	Loss	Temp.	High F. F. A. Oil Color	Loss
10°-12°C	9.3 R	12.2%	10°C	210 R	50.0%
17°-19°C	9.3	12.0	18°-20°C	225	52.0
26°-28°C	9.4	12.2	28°-30°C	210	57.4
36°-38°C	9.6	11.8	36°-38°C	220	73.1

The best results on color and loss seem to be obtained at the lower temperatures, the difference being especially marked on high F.F.A. oil. 20°C. was considered to be the best and most practical temperature for use.

Rate of Agitation Hot

R. P. M.	Low F. F. A. Oil Color	Loss	High F. F. A. Oil Color	Loss
40	9.1 R	11.8%	—	—
50	9.1 R	11.7	180 R	52.0
75	9.2	11.8	180	51.9
100	9.9	12.7	180	53.4
125	10.5	12.6	180	54.2

On the basis of these results 70 R.P.M. was adopted for agitating oil while heating. Higher speeds are distinctly injurious.

Temperature of Agitation Hot

Bath temperatures of 54°, 64° and 74°C. were used with eight minutes allowed for heating in each case. Practically no difference was found in the results on the low oil, but on the high oil a slightly better recovery of oil was made from the first settling, before remelting the foots, and also slightly better color was obtained with the 64°C. bath.

Rate of Heating

Time to reach 40°C	55°C	Low F. F. A. Oil Color	Loss	Time to reach 40°C	55°C	High F. F. A. Oil Color	Loss
2.6 Min	5.2 Min.	9.5 R	12.35%	2.3 Min.	4.2	240 R	54.8%
10.0 "	13.4 "	10.0 R	15.0 %	7.5 "	11.4	260 R	58.1%

It is very clear that the best results are obtained by heating as rapidly as possible. Slow or irregular heating by different operators will cause serious variations in results.

Temperature of Settling

No differences were found on the low F.F.A. oil when settled at temperatures between 40° and 75°C. Likewise, on the high F.F.A. oil, no appreciable difference in the ultimate loss or color was found, but more oil is recovered on the first settling, when the temperature is about 70°. 65° will probably be a safe and desirable temperature for settling.

Time of Settling Hot (60° —65°C).

Time	Low F. F. A. Oil Color	Loss	High F. F. A. Oil Color	Loss
½ hour	10.8 R	14.0%	190 R	57.4%
1 "	10.8	14.0	190	57.1
2 "	10.6	14.0	200	56.1
4 "	10.4	14.1	190	52.6
8 "	10.2	13.9	210	54.6
16 "	10.0	13.7	230	51.1

Note that on the low oil, the color improves but on the high oil it darkens on long settling. The loss shows an improvement on the high oil. The results obtained in the four-hour test are probably out of line. Two hours settling are probably sufficient for practical purposes.

Temperature of Cooling Foots

Rapid preliminary cooling on ice with subsequent standing at room temperature gave the same final results as when the preliminary ice cooling was omitted.

Angle of Dish During Draining of Oil

It was found that on the high F.F.A. oil a solid foots could not be obtained. Hence the angle was limited to that at which the foots would not flow out of the dish. On the low F.F.A. oil no appreciable difference, due to different angles, was noted.

Time of Draining Oil from Foots

Low F. F. A. Oil		High F. F. A. Oil		
Time	Loss	Time	Loss	
15 min.	13.60%	15 min.	60.53%	(Foots not remelted,
30 "	13.52%	30 "	60.43%	" " "
60 "	13.47%	60 "	60.31%	" " "

Practically nothing is gained after 30 minutes. A difference of .1 per cent on a 60 per cent loss is negligible.

Air Bubbles in Crude Oil

The effect of air bubbles introduced when shaking the sample was studied, by comparing results on samples containing the maximum possible amount of air bubbles with samples perfectly clear. No difference in results could be found.

Remelting of Foots

It was found on the low oil, that even one remelting was seldom necessary, but on high oil at least three remeltings were necessary in all cases.

Caustic Soda in Different Beaumé's

Refinings were made on each oil with lyes of different Beaumé but equal NaOH, using the amount specified as a maximum in the present rule.

Low F. F. A. Oil

F. F. A. = 4.4%

Lye %	Bé	Color	Loss
14.2	14°	11.8R	13.4%
10.6	18	10.6	13.6
9.3	20	10.5	14.3
8.4	22	10.2	14.8
7.5	24	10.0	14.9

High F. F. A. Oil

F. F. A. = 20.5%

Lye %	Bé	Color	Loss	Foots
38.0	16°	290	58.2	Very soft
29.0	20	230	52.3	Fairly soft

%	Bé	Color	Loss	Foots
23.5	24	260	52.7	Semi soft
19.3	28	Over 500	57.5	Granular
Second Series, using more Lye				
40.5	16	270	58.6	
31.0	20	220	54.7	
25.0	24	210	55.4	
20.6	28	385	66.4	

On both oils it appears that the weakest lye gives darker color, and on the high oil higher loss also. 20° seems to be best on the high oil and 18° to 20° on the low oil. Stronger lyes increase the loss without a compensating improvement in color.

Effect of Different Percentages of 20° Lye

Low F. F. A. Oil				High F. F. A. Oil			
Lye				Lye			
%	Bé	Color	Loss	%	Bé	Color	Loss
5.3	20°	21.7 R	32.2%	25	20°	390 R	48.9%
7.3	20°	12.6	12.0	27	20°	340	48.7
9.3	20°	10.6	14.5	29	20°	250	50.3
11.3	20°	10.1	17.3	31	20°	190	54.2
13.3	20°	9.4	19.8	33	20°	180	61.1

On the lower F.F.A. oil 9.3 per cent of 20° lye gives the best results. This is the amount specified as allowable maximum in our present rule. On the high F.F.A. oil 29 per cent of 20° is the maximum in the present rule, but 31 per cent gives a much lighter color with some increase in loss, but not enough in our opinion to offset the improvement in color. Apparently, from these tests and others not here recorded, the present table does not allow sufficient lye for best results on the higher F.F.A. oils.

Impurities in Lye

Studies are now under way of the effect of different impurities such as sodium carbonate, iron, aluminum, calcium and silica.

Summary

The principal points in the present method, which cause differences in results when conditions are varied, and which, therefore, are the probable causes of differences reported by different chemists are the following. These points must be rigidly standardized in any revision of the method if we are to obtain more concordant results for settlement purposes:

1. Agitation must be improved. The 1 inch straight paddle appears to be the best yet tried.

2. The rate of agitation in the cold must be closely controlled. A gear driven machine should be used at 250 R.P.M.

3. The rate of agitation hot must be likewise closely controlled by a gear driven machine at 70 R.P.M.

4. The time of agitation in the cold with the 1 inch paddle should be 10 minutes.

5. The temperature of agitation cold should be rigidly kept between proper limits. 18° to 22°C. appears most suitable.

6. Maximum temperature 60° to 65°C.

7. Rate of heating should be the quickest possible. 8 minutes in a water bath maintained at 65°C. appears the best and safest method. (Iron vessels without enamel were used in this work.)

8. Temperatures of settling hot: 65°C.

9. Time of settling hot: 2 hours.

10. Remelting foots. Remelt several times if necessary, until recovery is less than .5 per cent.

11. Choice of lyes must be rigidly limited.

12. Purity of lye. Effect to be determined later.

Future Work

As soon as the few remaining points now under investigation are completed, a revised method will be written up and comparative tests made on a number of crude oils, to determine two points: First, a comparison between the new and old method by different operators; and secondly, whether more consistent results are obtainable on the new method by different operators than on the old method, when working on the same oils.

It is probable that the apparatus used in different laboratories will also have to be standardized, not only as to size and shape of paddle but also size, shape and metal of refining vessel and the type of agitating device. The last must be so designed as to give always the same speed, without slipping. Two speeds—250 R.P.M. and 70 R.P.M. seem to meet all requirements.

Acknowledgment is given to Nelson W. Humbaugh, of this laboratory, who carried out the analytical work above recorded.

C. B. CLUFF, *Chairman*
Refining Test Committee
Ivorydale, O.

THE FATTY OILS OF SWEET CLOVER SEED— I: MELILOTUS ALBUS

BY B. A. DUNBAR AND C. F. WELLS

Melilotus albus, commonly called White Sweet Clover, together with more than twenty-five species occurring in the temperate and sub-tropical parts of the world, belongs to the botanical genus Melilotus. Its earliest history is little known. It has been used as a forage crop in Thibet for more than two thousand years. Being a native of Europe and Asia, it has never gained the prominence in its native habitat that it has in most parts of the New World. It probably had its origin in the high plateaus of western Asia, where alfalfa and red clover were first cultivated. It has been known in this country for almost two centuries, being found in Virginia as early as 1739 and in New England in 1785.

Melilotus albus is a biennial clover. Under natural conditions the seedlings appear early in the spring and by fall they may have reached a height of four to five feet. By fall the seedling has produced a large bulky tap root which may often extend to a depth of six to eight feet, as well as an extensive secondary root system. During the second year the plant shows a much larger growth, often reaching a height of eight to ten feet, and produces a number of white, sweet-scented flowers in the form of racemes. During early fall of the second year, they mature an abundance of seed which greatly resembles that of alfalfa. About the time of seed formation, the leaves begin to drop off. The plant contains a bitter substance having an agreeable, aromatic odor. This substance has been identified by other workers as courmarin. The young plant contains but small amounts of courmarin, but as it grows toward maturity, the coumarin content increases. The plant has a rank growth of stems, which rapidly become woody, and after the formation of seed, the plant dies. It belongs to the legume family and carries the same nodular bacteria as does the alfalfa plant.

Very few plants are able to supply as much organic matter to the soil as does the sweet clover. It reaches its optimum development in soils of high lime content. It will grow well on heavy clay soils or in coarse sandy ones. Even extreme alkali content does not inhibit its rapid growth. By reason of its deep root system, it is able to withstand drought as well as alfalfa. It can endure wet soils much better than any of the other clovers. On account of its wide soil range, it becomes a valuable forage crop where alfalfa and other clovers will not grow.

It has a wide climatic adaptation, growing from the Mexican border well into Canada. It endures the cold, dry winters of our northwest without winter-killing and the hot, humid summers of the south do not effect it.

The purpose of this study was twofold: (a) To ascertain whether the

physical and chemical constants of the oil of sweet clover seed grown in this country are similar to those reported by Grimme[1], for seed purchased on the Hamburg market. (b) To determine whether the domestic oil possesses commercial value.

The seed upon which we undertook these studies was produced by the Department of Agronomy of South Dakota State College, at their substation located at Highmore, South Dakota, thus giving it a high-land environment. The seed so furnished us through the courtesy of Dr. A. N. Hume of the above department, was of a yellowish-brown color, resembling that of the alfalfa plant. The seed of the sweet clover plant is quite small; according to Werner one pound of it may contain as many as 235,000 seeds.

Analysis of the Seed. The seed was ground through a common laboratory handmill, to a fine flour. The following table presents the results of analysis of the ground seed, in percentages by weight:

Moisture	6.58
Ether Extract	5.26
Protein	35.17
Crude Fiber	11.15
Ash	3.46
N. F. Extract	48.38

Preparation of the Oil. To prepare the oil for this work we proceeded as follows: The seed was first ground through a common laboratory mill, setting the crushers so as to crack the seed thoroughly, but not to reduce it to a fine flour. This meal was extracted in a specially constructed Soxhlet extraction apparatus. The capacity of the apparatus was approximately two kilograms of the meal. The oil was extracted with ethyl ether. Extraction was considered to be complete when the ether solution left no residue upon evaporation. The ether was now evaporated and the oil filtered through an ordinary filter paper in order to remove any finely ground flour which siphoned over with the oil-ether solution. The oil thus extracted had a greenish-amber color, with the characteristic coumarin-like odor. Its specific viscosity, Sayboldt, at 70° F. was 19.1.

Physical Characteristics of the Oil. The oil was found to be a drying oil, having a specific gravity of 0.9513 at 25° C., as determined by the picnometer. According to the Abbe refractometer, its refractive index was 1.4838 at 25° C.

Chemical Characteristics of the Oil. The saponification number of the oil was 203.3 and the iodine number by the Hanus method, 142.5. The results of these tests indicate a probable composition of the oil similar to that of popyseed oil, as to the nature of the acid groups involved and to its quality as a drying oil. To substantiate further our supposition of its drying quality, we oxygenated the oil by the methods of Livasche[2] and of

Hubl-Lippert.[3] The latter method gave much higher numbers. Thus:

Time of exposure—Days	Gain in % of weight
1	1.42
2	5.30
3	7.66
4	7.99

There was no further gain in weight after the fourth day.

According to the Livasche method we obtained the following results:

Time of exposure—Days	Gain in % of weight
1	3.48
2	3.78
3	3.78
4	3.78
5	4.00
6	4.15

There was no increase in weight after the sixth day.

The above data would rank the oil with the group represented by rapeseed, as to drying properties.

These results were confirmed by applying the elaidin test, using the method of Poutet.[4] At once an orange colored, buttery mass began to form, supernatant upon a watery liquid, and within twenty minutes the reaction was complete. This test would place the oil in the group represented by sesame, rape and sunflower. Its character as a drying oil is thus further established.

The specific Maumene number, as determined by the Woodman method, was 108.4. This still further points to the drying nature of the oil.

The Reichert-Meissl value was determined by the method of Lewkowitsch[5] and was 3.35. This would indicate a saponification number which would probably be above 200, a verification of the saponification number as determined directly.

The saturated and unsaturated (or solid and liquid) fatty acids were separated by the method of Gussarow-Varrentrop, as modified by Tortelli and Ruggeri.[6] By this method we found the oil to contain 78.7% of unsaturated or liquid fatty acids, and 8.2% of saturated or solid acids.

Using the method of Allen and Thomson,[7] we found the unsaponifiable matter to be 3.05 per cent.

The glycerol content of the oil was 11.11 per cent, calculated from its saponification number.

The iodine value (Hanus) and neutralization number were determinded upon the saturated and unsaturated fatty acid fractions as follows:

	Neutralization No.	Iodine No.
Unsaturated acids	198.9	147.16
Saturated acids	216.3	68.05

These results further substantiate the corresponding numbers from the original oil.

From the above neutralization numbers, we calculated the mean molecular weights of the two types of acids, as follows: Unsaturated, 282.1;

saturated, 259.75. It is assumed from these molecular weights that the saturated fraction is largely palmitic acid, and that the unsaturated portion is of the oleic type.

The acetyl value was found to be high; it required 43.13 mg. of potassium hydroxide to neutralize the acetic acid produced from the hydrolysis of one gram of acetylated fat.

The free fatty acids, as determined by the method of Pickering,[8] were 4.08 per cent.

Qualitative Tests. In addition to the above quantitative tests of the oil, certain generic tests of a qualitative nature were made.

The Molisch test for carbohydrates, the ferric chloride test for phenol derivatives, and the phenylhydrazine reaction for ketones, all gave negative results. The Schiff reaction was positive for aldehydes, although these bodies occurred in traces only, insufficient to warrant a quantitative examination.

Summary and Conclusions. The experimental data as presented in this paper warrant the following conclusions: (a) The chemical composition of this oil is markedly different from that reported by Grimme,[9] as shown in the following summarized table:

	S. D. Seed	Grimme
Specific Grav. at 25°C	0.9513	0.9310
Free Fatty Acids	4.08%	7.80%
Saponification Number-Oil	203.3	189.9
Iodine Number	142.5 (Hanus)	71.4 (Wijs)
Unsaponifiable Matter	3.05%	2.05%
Glycerol	11.11%	9.42%
Fatty Acids	86.90%	93.25%
Quality of oil as a dryer	Drying	Non-drying
Sp. Maumene No.	108.4	
Reichert-Meissl No.	3.45	
Neutralization No.—Unsat. Acids	198.9	
Neutralization No.—Sat. Acids	216.3	
Iodine Value (Hanus)—Unsat. Acids	147.16	
Iodine Value (Hanus)—Sat. Acids	68.05	
Mean Molec. Wts.—Unsat. Acids	282.1	
Mean Molec. Wts.—Sat. Acids	259.75	
Acetyl Value	43.13	

Evidently the constants of the oil from this seed, grown under varying conditions as to soil and climate, differ widely.

(b) The above data indicate that this oil possesses commercial value as a substitute for the drying oils.

The oil of Melilotus officinalis will be the subject of a future study.

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CHEMICAL COMPOSITION OF OKRA SEED

BY J. O. HALVERSON AND B. NAIMAN

The resemblance of the Okra plant (Hibiscus esculentus, (L.), Malvaceae) to the cotton plant, both of which belong to the same botanical family, suggested that the analysis of the seed may show similar composition.

The oil has been analyzed[1] but not the seed so far as the authors are aware. It seemed desirable to ascertain also its chemical composition.

Table I—Composition of Okra Seed, Meats and Hulls

No.	Variety	Ash	Calcium	Moisture	Crude Fat	Crude Fibre	Nitrogen*	Protein (x6.25)
1	Tall green-long pod	3.93	0.155	9.05	17.79	24.83	3.45	21.56
2	Tall green-long pod	4.28	0.207	8.05	14.66	26.96	3.17	19.81
3	Dwarf—thick pods	2.90	0.224	6.15	22.03	19.68	4.17	26.06
4	Dwarf—thick pods	4.16	0.189	9.65	17.66	25.75	3.29	20.56
5	White Velvet—white pods	2.11	0.276	9.28	15.31	25.35	3.62	22.63
6	White Velvet—white pods	4.94	0.197	5.67	16.53	27.62	3.20	20.00
7	Meats of Dwarf Okra seed, hulls removed...	5.99	0.174	4.63	32.48	4.78	5.53	34.56
8	Hulls of Dwarf Okra seed, meats removed ..	1.69	0.214	7.28	4.33	45.66	1.31	8.19

The analysis of 7 samples show a high calcium content in the ash. The seeds also contain considerable crude fat and crude protein, both being of the same magnitude as that of the seed of the cotton plant. This is brought out more clearly in Table II where the chemical composition of the seeds of the cotton and okra plants are given on the moisture-free basis.

Table II—Average Analysis of the Seed of Cotton and Okra Plants Compared (On Moisture-free Basis)

	No. of Analysis	Ash	Calcium	Moisture	Crude Fat	Crude Fibre	Crude Protein
Cottonseed (Henry and Morrison)[2]	38	4.9	...	..	20.21	24.04	20.74
Okra Seed (Halverson and Naiman)	6	4.7	.261	..	21.72	31.37	27.28

The average protein of the six samples of okra seed is 6.54 per cent higher than for the seed of the cotton plant while the per cent of fat is about the same.

It is interesting to note the similarity of composition of the seeds although the plants belong to different genera of the same family. A further relationship is shown in the oil, both of which give the Halpen Color Test.[3]

The mature seed of the okra plant possesses good feeding value in

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* The authors are indebted to L. M. Nixon for these results.

[1] Okra Seed Oil, George S. Jamieson and Walter F. Baughman, Jr. Am. Chem. Soc., Vol. 42, 166, 1920.

[2] Feeds and Feeding, W. A. Henry and F. B. Morrison, 18th Ed. 709, 1923.

[3] George A. Jamieson and Walter F. Baughman, Jr. Am. Chem. Soc., Vol. 42, 166, 1920.

that it consists of ¼ protein and ⅕ oil. This plant being prolific and a vigorous grower in the Cotton Belt has possibilities of economic importance due to its high oil content and to the feeding value for animals of the high protein meal remaining after the oil is extracted.

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OUR TRADE IN VEGETABLE OIL INCREASES

United States trade in the consumption of vegetable oils for the year 1925 is characterized by a substantial increase over that of 1924, there having been a fairly steady increase since 1922, which year marked a low point, due largely to the drop in exports of cottonseed oil.

The increase in production of vegetable oils from 1912 to 1919 was 242,568,000 pounds. During the period of deflation the production fell off considerably, but since 1922 the quantity produced annually has been steadily increasing, reaching a production in 1925 of 2,642,904,000 pounds, which is the largest in the history of the industry.

The crushing of peanuts and soy beans shows the largest percentage increases. Prior to the war but 454,000 pounds of peanut oil were produced, whereas in 1925 the amount was 15,852,000 pounds. Production of soy bean oil was of no consequence before 1922, most of the oil coming from Manchuria and Japan. The growing of soy beans has greatly increased, and consequently the expression of bean oil in this country on a small scale has been brought about, products in 1925 amounting to 1,405,000 pounds. The only oils which show a decrease in production are olive, palm kernel and rapeseed.

The Netherlands is the largest European consumer of American vegetable oils. Practically all of the product taken by that country is refined cottonseed oil, which is used principally in the manufacture of oleomargarine. The only other European countries that import any appreciable amount of American oils are Germany and Norway. The bulk of our export trade is carried on with our North American and West Indian neighbors, principally Canada, Mexico, Cuba and the Dominican Republic.

Canada is by far the largest consumer, and its principal importation is crude cottonseed oil, most of which is used in the manufacture of lard compounds and soaps. The trade with Mexico in cocoanut and cottonseed oil fell off 237,595 pounds in 1925, compared with 1924, while the trade with Cuba and the Dominican Republic increased. There was also a substantial increase in the shipment of these oils to other countries.

DETECTION OF ALPHA-PALMITO-DISTEARINE IN PRESENCE OF BETA-PALMITO-DISTEARINE

Translated from Cemisch Weekblad with permission

By F. J. F. MUSCHTER AND G. VISSER

In the literature on oils and fats (Holde, Marcusson, Gruen, Benedikt-Ulzer, etc.) methods are given for differentiating lard (from which alpha-palmito-distearine is crystallized) in presence of tallows (the associated component of which is the beta isomer); among others there is the method of Boemer, which is known as the Boemer melting-point-difference method. On account of lack of space we refer those interested to the literature, but for clarity we note that the value Sg + 2d, in the case of hog fat is more than 71, while in mixtures of lard with tallow, for example, beef fat in a minimum amount of 10 per cent of tallow, this value becomes smaller than 71.

Ad. Gruen, in his recent work, "Analysis of the Fats and Waxes," has assumed a very skeptical attitude toward the two-sided application of this Boemer value; on the ground that Boemer values above 71 do not on the whole give any guarantee of the purity of lard (ibid, page 360). The trade buys and sells on Boemer values. If these are above 71 the goods pass for pure lard, and, if not, the lot is declined (justly so, in this case) as adulterated with substances that are not lard, and among these tallow comes first into consideration.

It is precisely on account of the fact that Boemer values above 71 tell nothing, that an incentive is given to the use of methods like that in the distinguished work: "Food Inspection and Analysis," by E. Leach and A. E. Winton. This method consists chiefly in determining the iodine number, refraction, and saponification number of the sample, and tests are also made for vegetable constituents, train-oil, hardened oils; and in addition a microscopic investigation is made as to the presence of any tallow, which may be in the mixture (quantities of 0.5 — 1 per cent can now be detected), and whereby a possible adulteration with beef, goat or sheep fat may be brought to light.

This involves the microscopic determination of alpha or beta palmito-distearine, a method of differentiation which in fact is so sensitive that in this place we wish to go into the matter somewhat further.

After various attempts with the method as given in the literature it soon transpired that it must be discarded as much too troublesome; the differentiation of the two crystal forms, without some better means, is almost impossible, so that, somewhat regretfully, attempts were made to find better methods.

We tried to make the two isomers each separately visible in presence of the other, which might, for example, be done in the following manner:

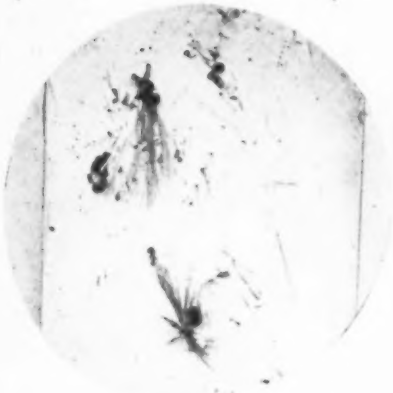

Fig. 1

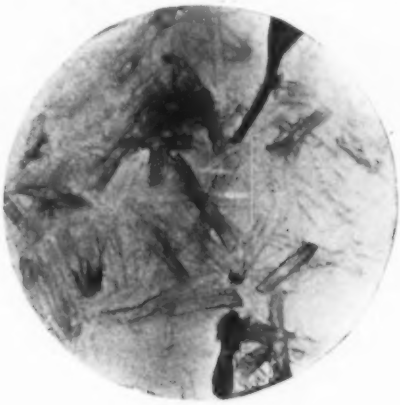

Fig. 2

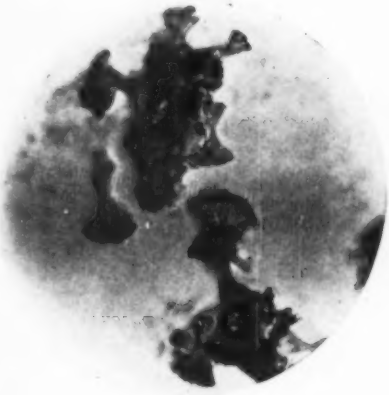

Fig. 3

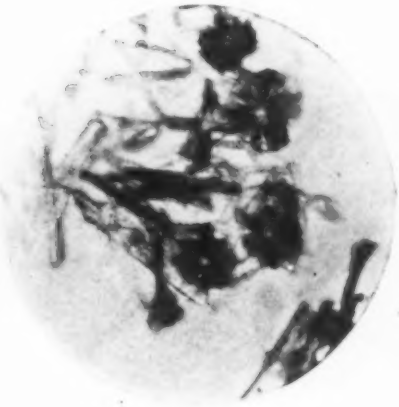

Fig. 4

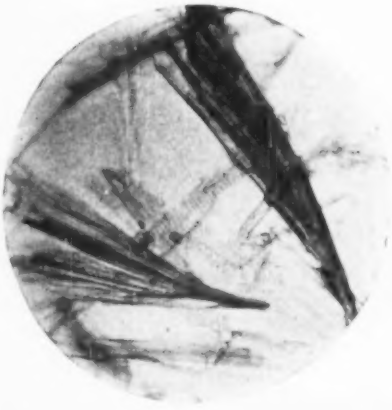

Fig. 5

Fig. 6

One of the isomers may be camouflaged by placing it in a liquid medium of the same index of refraction, and thus, if the index of refraction of the other isomer is different, only one of the isomers will be visible.

While it was seen, *a posteriori,* that this method must be discarded, we will here add certain particulars regarding the determination of the refractive index—among others the corrections—chiefly for the reason that in the customary American method this determination is prescribed.

As media for the determination of the refractive index of the crystals we have chosen ethereal oils of different refractive indices, which, by mixing in various proportions, would give media with refractive indices like those of the isomers. On determining these indices by microscopic methods it immediately became apparent that the indices of the two isomers here considered lie very close together.

Due to the fact that the composition of the medium under observation was subject to change by partial evaporation during the operations, the exact determination of the indices was very troublesome. After various experiments we are inclined to ascribe to the alpha isomer a somewhat greater index than that of the beta isomer, namedly n_{15}^{D} 1.518 — 1.5186 for the alpha, and n_{15}^{D} 1.5180 — 1.5182 for the beta compound.

In the melted condition (at 70° C.) the indices are practically equal and differ at most by one unit in the fourth decimal place, namely: For the alpha isomer n_{70}^{D} 1.4423 — 1.4424; for the beta compound n_{70}^{D} 1.4424.

The alpha compound we obtained from leaf lard, the beta compound from beef fat, both by crystallization as is more particularly described at the end of this paper.

We determined the indices in the liquid phase, with the help of an Abbe refractometer.

As a correction factor for one degree centigrade, 0.0004 has been assumed for neutral fat. If passage into another phase should not require any other value for the correction factor, then in recalculating n_{70}^{D} into n_{15}^{D} there must be added to the value of n_{70}^{D} 55 $\times$ 0.0004 or 0.0220, so that the value of n_{15}^{D} will be found to be: 1.442 + 0.0220, or 1.4644.

In reality n_{15}^{D} is 1.5183, so that it follows at once that the correction factor holds only for the liquid phase.

In connection herewith we call attention to the fact that the determination of the index of refraction of lard or of beef fat at a temperature of 40° C., where two phases are present, may not be accurate. The reading at this temperature (below the melting-point) is in fact very unsatisfactory, since the line of division between the two fields is not sharp, and in consequence there can be no talk of an accurate adjustment of the cross-hair on this line.

It is thus desirable to give the indices at a temperature which lies somewhat above the melting-point, because here there is only one phase present, and by means of a correction-factor it can then be recalculated to the index at the temperature of the melting-point, or higher.

It has also repeatedly seemed to us to be advisable to determine the index at constant or slowly rising temperatures, not at decreasing temperatures when operating much above the melting-point. Under the last named circumstance the refraction does not increase with the fall in temperature (as would be expected), but remains stationary, so that application of a correction leads to totally misleading results. It is remarkable that the index does not remain stationary at progressive (rising) temperatures. No single case of this kind has been observed. Whether the opposite phenomenon has any connection with the known condition of over-melting is still an open question.

For completeness, we will note that the value of the refractive index for one degree of higher temperature becomes 0.0004 lower, and conversely becomes 0.0004 higher for one degree of lower temperature than is read off on the refractometer.

Since these optical methods have not supplied us with a method for easily differentiating the isomers, we have made use of a means employed in bacteriology, namely, coloring by means of organic dyes.

That an improvement would also result in the taking of microphotographs was to be expected. The coloring of the crystals facilitates the distinguishing of the crystal form, chiefly by showing the particular isomer in perspective. For this purpose a very small portion of the mixture of glycerides (first crystallization direct from ether, after which the crystals from the first crystallization are recrystallized from ether—absolute alcohol 50:1) is obtained, placed upon an object glass, and stirred with one or two drops of a Romanowsky-Giemsa solution (azure-eosin, as it occurs in the trade, is diluted for this purpose with six times its amount of absolute alcohol).

The crystals become colored after 4 to 6 minutes—that is, they become covered with the dye particles, and can now be studied under the microscope.

One begins with a small magnification (100 to 180 fold) and a search is made for typical growth-forms such as are pictured in the accompanying micro-photographs. These growth forms (crystal habit) are characteristic of each isomer.

After this, the magnification is increased to 400 or 500, this time to determine the form of the rhombohedrons or the cylinders. If necessary, the magnification is increased to 900, but in this case it must be borne in mind that no immersion is to be used, because immersion liquids often

wash off the dye with which the crystals are covered (not impregnated). During these observations the following is kept in mind: The alpha isomer occurs mostly in flat rhombohedra, which can easily be distinguished at a magnification of 100; they appear as bodies on the surfaces of which are seen evenly spaced parallel ribs, while the ends of the crystals are sharply cut off. These bodies may appear singly, crossed, in regular star forms, in rosettes and also (though seldom) in fan shapes.

These fans are always simple, that is, they consist of crystals which, beginning at a point, grow radially in definite directions out into space. Double fans (two simple fans, with their pointed sides placed opposite each other) often occur in the beta isomer. Here the two halves mostly differ in dimensions, and are therefore often unsymmetrical.

These fans or sectors, on their circular outer boundary, have projecting crystal ends which in the alpha form are sharply cut off; in the beta isomer they are pointed or rounded off. In a mixture of both isomers, observation of the outer ends of these clusters will disclose both sharply cut off and rounded ends; in such a case it is difficult to decide whether a fan is formed principally of the one or the other isomer; coloring the complex intensifies the perspective and one generally succeeds in making the desired identification. In general, it is the form of the outer end of the crystal (aside from the formation) that is decisive, and if the same isomer is found in *different* parts of the preparation, a conclusion can be drawn as to the presence of the corresponding species of fat.

The beta crystals occur in cylinder-like needles, the outer ends of which appear round or pointed, and if the needle can be observed in such a position that the light from a polarizer can pass through it, a small bright circle (ellipse) may be seen. One should be careful, however, not to confuse small fat globules (consisting of liquid fat) with

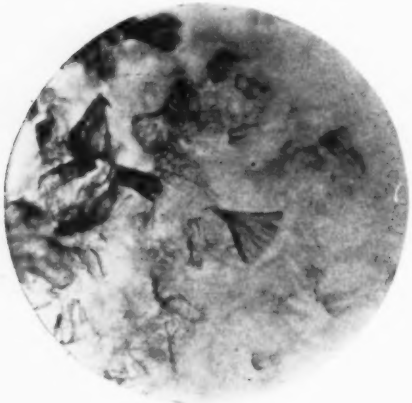

Fig. 7

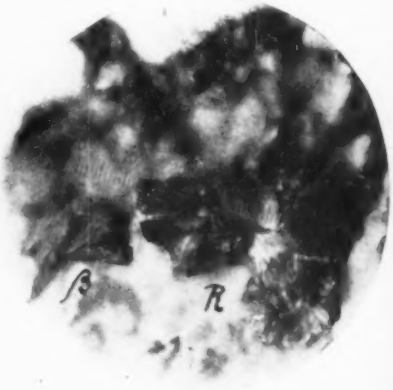

Fig. 8

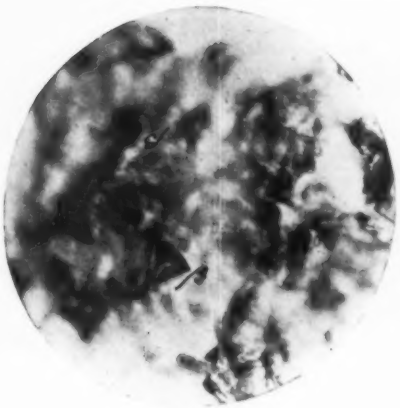

Fig. 9

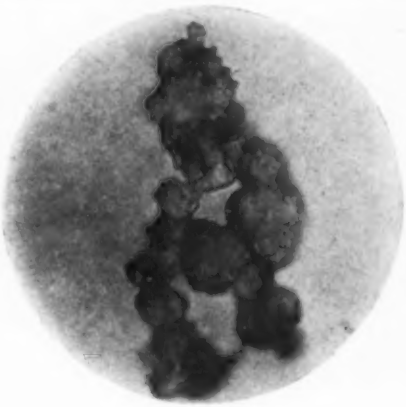

Fig. 10

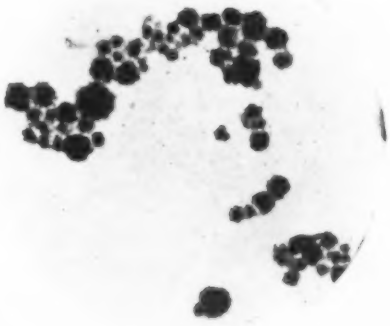

Fig. 11

these terminations of the needles; an unsatisfactory crystallization results in the undesirable presence of more over-saturated components in the preparation, which evaporation of the fat-solvent leaves behind as small globules. This phenomenon will occur if the crystals are not washed.

The beta crystals occur also in bent form, whereas the alpha isomer is exclusively rectilinear. The fans formed from the alpha isomer are also formed by joining together their obtuse angled ends, so that from rectilinear crystals, what on superficial observation has the appearance of a bent needle may be formed.

As illustrations we have inserted eleven of the photographs of the colored photographs, which, we hope, will contribute to a clearer idea of the crystal forms which are to be differentiated. It should not be forgotten, however, that when working with the microscope and making use of the stronger objectives or oculars, only one surface can be brought

sharply into the focus, so that details of the whole crystal or its growth-habit cannot be shown in a single microphotograph.

We will now pass to the descriptions of the microphotographs, which were taken with the help of a pointed light and chromate filter (saturated aqueous potassium chromate solution) on Agfa-chromo-isolar plates.

We see in Fig. 1 a picture of uncolored alpha crystals. Only the fan forms are clearly visible, the flat rhombohedra do not appear to their best advantage. How this condition may be improved is shown by Fig. 2, where the flat bodies with their sharply cut off ends are clearly visible. Fig. 3 shows a collection of beta crystals here one sees the double form, mostly consisting of a large and a small fan, which show a fine rectilinear rayed structure. This rayed structure is caused by the radial positions of the needles, which, however, do not all lie in one plane.

The pretty rosette forms are found in Fig. 4, while Fig. 5 is a greatly enlarged picture of an alpha fan. It is only necessary to look at the end-points to be certain of the identification of the alpha isomer. We here see that what is stated for example in Gruen's work (previously cited) regarding the beta isomer on page 359, that the "horse-tail-like" form indicates the presence of beef fat, is not necessarily true, since the same form is also possible with the alpha isomer. By stronger magnification a fan which is at first regarded as a beta fan may really turn out to be an alpha fan.

The series, Figs. 6, 7, 8, 9, shows pictures of forms which owe their origins to mixtures of beef and hog fats.

In all the figures of this series one clearly sees the beta fans, while in Fig. 7 a deceptive alpha fan occurs; deceptive in that, on first sight, it has the appearance of a beta fan, but which on closer examination is found to be classifiable among the alphas.

In Fig. 8, a beta fan occurs along with an alpha rosette.

If crystallization is effected from a mixture of ether (4 parts) and of the stronger objectives of oculars, only one surface can be brought absolute alcohol (1 part), the fan forms seldom occur, and when they do occur, they cannot be distinguished. The fan forms occur practically only on crystallization from ether (a little absolute alcohol is not disturbing).

The differentiation of the beta isomer by crystallization from ether and alcohol requires long practice.

We note that here and there evenly spaced cylindrical forms occur, the ends of which are cleanly rounded in contrast to almost similar appearing alpha forms with their sharply cut off ends, while the ribs of the rhombohedrons give the impression of evenly spaced staves, which might easily be confused with the cylinders of the beta isomer.

Finally, we will make a few remarks on the method of crystallizing.

To obtain well-formed crystals, crystallize twice, the first time from ether (one part fat, 2 parts ether), the next from ether and about 2 per cent of absolute alcohol (one part fat and 5 to 6 parts ether alcohol) in order to avoid malformations as in Fig. 10, where the various crystal forms are covered with lower melting fractions. Further, the crytallization should be done rapidly, that is to say, with vigorous agitation and at as low a temperature as possible (10° to 15° C.), otherwise not clearly definable groupings will be formed, such as may be seen in Fig. 11.

After each crystallization wash once with 1 to 2 cc. of the solvent. A small suction filter can be used to advantage.

We can recommend to the reader to make one trial with the Giemsa-Romanowsky dye (azur-eosin, as used in bacteriology).

The method of working is very simple: A very small quantity of the crystals is placed upon a preparation glass. After this one or two drops of the dilute dye solution are carefully dropped on; the crystals are carefully stirred and thinly spread out with a thin rod, one or two mm. in diameter, the end of which has been rounded by fusion; after 4 to 6 minutes the preparation is examined under the microscope. The preparation thus obtained keeps well without cover glass or fixation and can be kept standing on end in preparation-beakers without fear of the crystals falling off.

It is self-evident that the coloration of crystals, where the perspective is heightened, opens new paths for fundamental crystallographic investigations in other fields than the one here considered. In conclusion, we will gladly furnish further information or particulars to those interested in the matter.

Summary

The testing of hog fat for the presence of tallows according to the Boemer melting-point-difference method gives, in a case where Sg + 2d lies above 71, no certain indication of a possible adulteration, so that reliance cannot be placed on this method in this connection.

Only a competent microscopic examination, in which the isomers alpha and (in presence of) beta palmito-distearine are identified, does this test give certain proof of a possible adulteration with tallow. For the purpose of simplification, the crystals may be colored with the Romanowsky-Giemsa dye whereby the certainty of recognition of these isomers is greatly increased.

Micro-photographs, which have been taken after previous coloration on Agfa-chromo-isolar plates (with yellow filter) show a perceptible improvement of the picture, especially as regards the background.

Preparations of these colored substances can be kept in an upright position on the object glass without special fixation.

DIET AND BODY FAT

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BY LAFAYETTE B. MENDEL AND W. E. ANDERSON

In a study[1,2] of the influence of diet upon the quality of fat produced in the animal body we found when rats were fed diets containing dried skimmed milk and either peanut oil or soybean oil or corn oil, these dietary oils furnishing about 60 per cent. of the total food calories in each case, the fat or rather oil yielded by the rat in each case was quite similar in iodine number value to that of the food oil. On the other hand, when a diet containing dried skimmed milk and starch (the latter being substituted equicalorically for the oil ingredient of the above diets) was fed, a so-called "hard" fat was obtained. Under all experimental conditions, cod liver oil and yeast were added to the ration as sources of vitamins.

Furthermore, we found it possible to convert the "soft" body fat into a "hard" body fat by changing the oily diet to the carbohydrate-rich diet, provided the change of food took place when the rats were of adolescent age (140-150 gm.) and the feeding of the "hardening" diet was continued over a comparatively long period. For example, the "soft" body fat of 140 gm. rats produced on a soybean oil diet was completely "hardened" on the carbohydrate-rich diet when the latter was fed until rats attained the weight of about 250 gm.

The question naturally arose: What would be the effect of fat depletion through selective starvation on the subsequent rate of "hardening" of the body fat?

In seeking an answer we subjected rats, grown to various weight levels on the oil-containing diets, to a starvation process before feeding the "hardening" diet. We then compared the fat obtained from other rats raised under exactly the same dietary conditions but not subjected to the fat depletion treatment through starvation.

In Table I will be found data obtained with six male rats, all of which were raised to a body weight of 250 gm. ($\pm$ 3.0 gm.) on a diet containing liberal inclusion of soybean oil. During the period of (partial) starvation, to which rats 1456, 1463 and 1464 were subjected, the soybean oil diet was entirely withdrawn, but the vitamin-bearing materials were supplied daily to prevent body depletion thereof.

It will be noted that the fat produced by the starved group of rats is distinctly "harder"—using the iodine number value[3] as a measure of "hardness"—than the fat yielded by the non-starved group. For ready comparison the iodine number values of fat produced by rats fed the soybean oil diet and by other rats fed the diet rich in carbohydrate are added. The amount of the dried skimmed milk and starch diet—"hardening" food—consumed by both the starved and non-starved groups, and the number of days during which it was ingested, are also indicated.

TABLE I

Rats 1456, 1463, 1464, 1448, 1454 and 1462 (all males) raised to 250 gm. (± 3.0 gm.) on D.S.M. (dried skimmed milk) and soybean oil.

Rat										
1456	starved	from	248	gm.	to	184	gm.	(25.8	per cent.	loss)
1463	starved	from	248	gm.	to	182	gm.	(26.6	per cent.	loss)
1464	starved	from	247	gm.	to	185	gm.	(25.1	per cent.	loss)

Rat									Killing weight	
1456	fed	D.S.M.	and	starch	from	184	gm.	to	275	gm.
1463	fed	D.S.M.	and	starch	from	182	gm.	to	280	gm.
1464	fed	D.S.M.	and	starch	from	185	gm.	to	272	gm.

Rat									Killing weight	
1448	fed	D.S.M.	and	starch	from	251	gm.	to	280	gm.
1454	fed	D.S.M.	and	starch	from	250	gm.	to	288	gm.
1462	fed	D.S.M.	and	starch	from	249	gm.	to	268	gm.

Rat	Iodine number (Hanus)	D.S.M. and starch diet consumed in days	
		gm.	
1456	71.4	453	27
1463	76.0	533	35
1464	71.5	435	27
1448	115.5	442	31
1454	108.5	355	26
1462	109.9	406	28

(123.0 = iodine number of fat produced by rats fed D.S.M. and soybean oil.
60.0 = iodine number of fat produced by rats fed D.S.M. and starch).

TABLE II

Rats 1488, 1479, 1487, 1478, 1490 and 1492 (all males) raised to 175 gm. (± 3.0 gm.) on D.S.M. (dried skimmed milk) and peanut oil.

Rat										
1488	starved	from	172	gm.	to	126	gm.	(26.7	per cent.	loss)
1479	starved	from	175	gm.	to	128	gm.	(26.9	per cent.	loss)
1487	starved	from	175	gm.	to	134	gm.	(23.4	per cent.	loss)

Rat									Killing weight	
1488	fed	D.S.M.	and	starch	from	126	gm.	to	228	gm.
1479	fed	D.S.M.	and	starch	from	128	gm.	to	233	gm.
1487	fed	D.S.M.	and	starch	from	134	gm.	to	221	gm.

Rat									Killing weight	
1478	fed	D.S.M.	and	starch	from	177	gm.	to	225	gm.
1490	fed	D.S.M.	and	starch	from	173	gm.	to	224	gm.
1492	fed	D.S.M.	and	starch	from	175	gm.	to	225	gm.

Rat	Iodine number (Hanus)	D.S.M. and starch diet consumed in days	
		gm.	
1488	61.9	301	20
1479	63.5	339	21
1487	68.0	365	24
1478	78.3	372	21
1490	75.0	345	24
1492	74.3	314	24

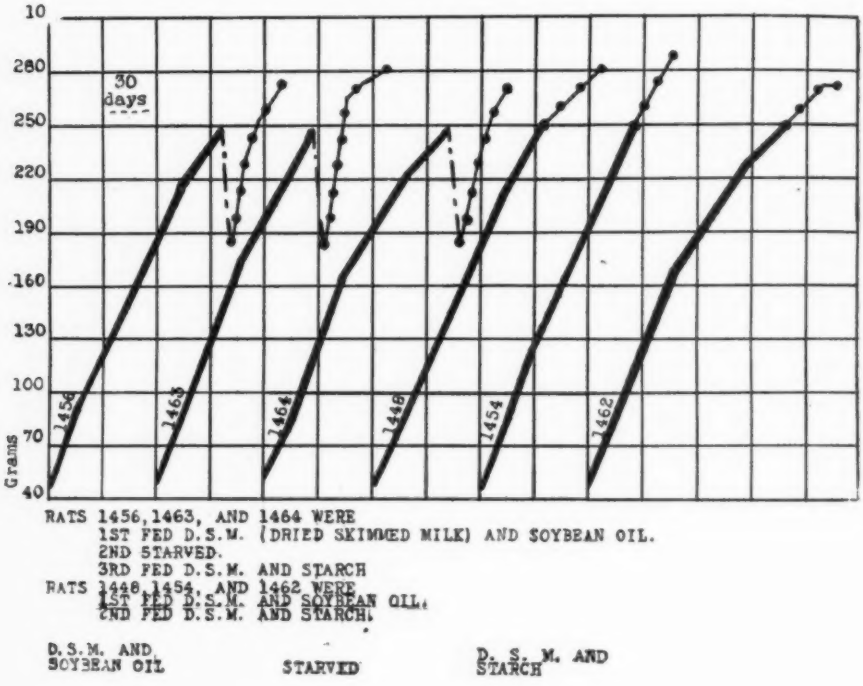
(94.0 = iodine number of fat produced by rats fed D.S.M. and peanut oil.
60.0 = iodine number of fat produced by rats fed D.S.M. and starch.)

In Table II will be found similar data obtained with six male rats, all of which were raised to 175 gm. ($\pm$ 3.0 gm.) on a diet containing peanut oil. The method of conducting and the details of this experiment were precisely the same as those referred to in Table I.

Not only is the fat ultimately produced by each rat of the starved group harder than the fat of the non-starved group, but the amount of "hardening" food consumed by the starved group is slightly less than that consumed by the non-starved lot. This is a striking example—and we have noted other similar instances in our present studies—of the food economy, measured in calories, in the starvation-recovery process.

By reference to the accompanying growth curve charts I and II one

CHART I



can readily visualize the very rapid growth experienced during recovery by all animals of both starved groups.

The results referred to are typical of others which we could furnish. We have performed similar experiments in which rats have been raised to various weight levels on diets containing corn oil in addition to those containing soybean and peanut oils.

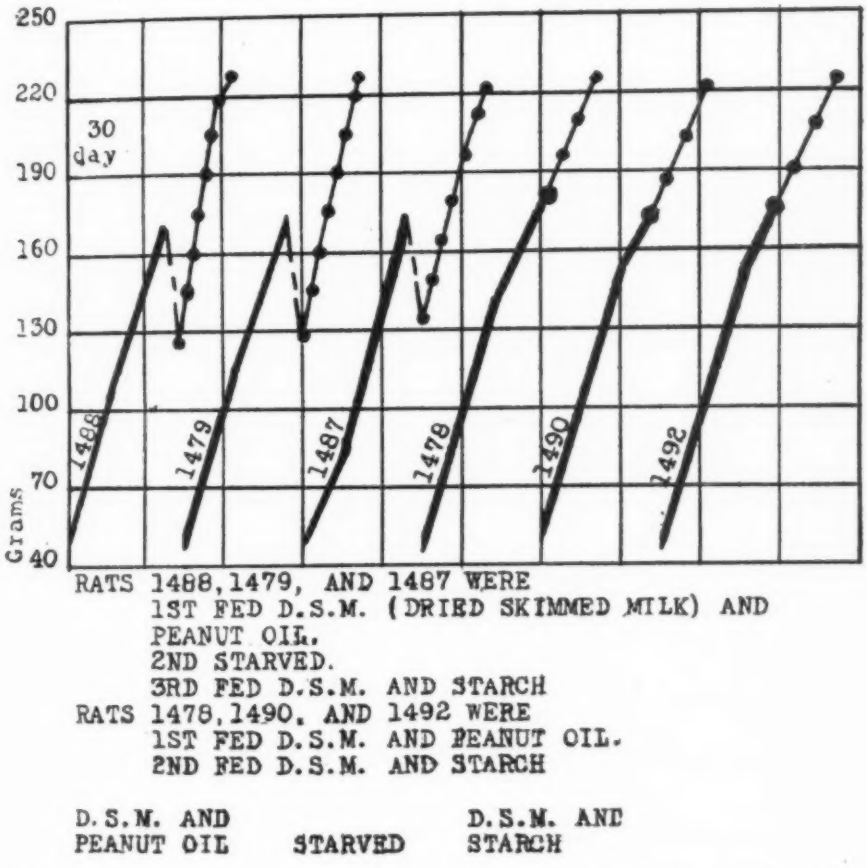
Experiments are in progress in which rats are being subjected to a

longer starvation process, involving over 30 per cent loss in weight. Upon completion of these studies the results will be published *in extenso*.

Summary

Rats first fed soybean oil and peanut oil diets, then subjected to the process of fat depletion through selective starvation, involving 23 to 27 per cent loss in body weight, before being fed a "hardening" diet, yielded "harder" fats—fats of lower iodine number values—than the fats of rats

CHART 2



which were not starved before being fed the carbohydrate-rich diet. In other words, through the process of starvation, the "soft" oily fat produced on diets containing soybean[4] or peanut oils is very largely removed, thereby permitting the deposit of a "hard" fat. To obtain a fat of equal "hardness"

from rats which were not subjected to the starvation treatment would have required a much longer period of feeding of the diet rich in starch than was found necessary with rats after first being starved.

The growth of recovery made by the rats of the starved lots was made on a low food intake. With the starved rats first fed peanut oil, the food intake of the carbohydrate-rich diet was less than with the non-starved group.

The possible application of these findings to practical animal husbandry is obvious.

YALE UNIVERSITY.

[1] Anderson, W. E., and Mendel, L. B., "A Technique for the Study of Fat Production in Animals," Proc. Soc. Exp. Biol. and Med., 1923-24 (21), 436.

[2] Anderson, W. E., "The Influence of Diet on Fat Production in the Animal Body," Proc. Am. Soc. Biol. Chem., *J. Biol. Chem.*, 1925 (63), XLVI.

[3] Ellis, N. R., and Isbell, U. S., *J. Biol. Chem.*, 1926 (69), 237, in their "Soft Pork Studies" state "the iodine and refractive index values were an excellent measure of firmness of the adipose tissue."

[4] The Procter and Gamble Company, Ivorydale, Ohio, kindly furnished the *soybean* oil used in these particular experiments.

EFFECT OF ULTRA-VIOLET RAYS ON COD LIVER OIL

It has been demonstrated by a number of investigators that some types of edible oil and oil containing substances when subjected to irradiation by ultra-violet light acquire antirachitic value. As the results of this information, a question obviously arose as to whether the antirachitic potency of cod liver oil could be increased by treating the oil with ultra-violet light.

The Research Laboratory of E. L. Patch Company, Boston, has been conducting co-operative studies to secure information on this point. The results of preliminary study appeared in a paper, "A Comparison of the Antirachitic Potency of Irradiated Cod Liver Oils by Edwin T. Wyman, M.D. (Instructor in Pediatrics, Harvard Medical School), Arthur D. Holmes, Ph.D.; Lawrence W. Smith, M.D. (Director of Medical Research and Chief of Staff, Boston Floating Hospital); Donald C. Stockbarger, Sc.D. (Instructor in Physics, Massachusetts Institute of Technology), and Madeleine G. Pigott.

The results obtained in the preliminary study indicated that there was little if any difference between antirachitic potency of oil that had been subjected to ultra-violet irradiation and the potency of oil from the same lot that had not been subjected to ultra-violet light.

NEW METHOD OF OLIVE OIL EXTRACTION

In the current issue of the Italian oil industry journal (*L'Industria degli Olii e dei Grassi*) Professor Michele degli Atti points out that, in its general outline, the process of oil extraction from the olive has remained almost unchanged from the beginning; that is to say, it consists in first pulping the fruit and then extracting the oil by pressure. The same general method is followed in the extraction of fruit juices generally, such as the production of grape juice, for example. In such cases, however, one is dealing with the extraction of a homogeneous liquid, and with the mechanical aids now available the yield is comparatively high. But with the olive, conditions are somewhat different, since the juices contained in this fruit consist of two liquids of very varied consistency from the physical point of view. The first is an aqueous solution of salts, acid, etc., whilst the other and considerably lesser constituent is a fatty substance, more or less viscous, and certainly much less fluid than the aqueous solution. When subjected to pressure the watery content passes out readily enough, but the more viscous oily matter does so only with difficulty and tends to block the press, especially towards the end of the operation, when the percentage of oil in the pulp is much greater than that of aqueous solution. Ultimately at least 10 per cent of oil is left in the residue. Besides being inefficient, the process is costly, involving the use of high power and the necessity of subsequent extraction with solvents. Numerous attempts have been made to find a better and cheaper method, but so far, says Professor Michele degli Atti, with little success.

Variation of Constituents

Analysis of different samples of olives grown under different conditions shows that the main constituents vary within the following limits: water of vegetation (aqueous solution) 45 to 60 per cent, oil 25 to 30 per cent, solid organic matter 12 to 22 per cent. The total liquid portion therefore amounts to 80 to 90 per cent of the whole, and of this two-thirds is aqueous solution and one-third oil. After removing the skin or endocarp, the fleshy portion is completely ground up, the oil cells being thoroughly broken so that all the juice is set free, and an unstable emulsion of fatty matter and water, containing a certain proportion of solid particles in suspension, is formed. The separation of the oily material from such an emulsion may, of course, be effected without the use of power. Such separation is all the more perfect in proportion to the completeness of grinding. This disintegration, however, is not to be confounded with mere pulping, since this pulp is really a mass of minute particles, including a considerable proportion of unbroken cells. If the disintegration is sufficiently thorough the emulsion formed may be merely left to settle and the oil may be decanted off.

Another Method

Another method is to place the pulp in cloth bags, in which case the oily matter passes out readily enough, whilst the organic solid matter and aqueous residue remains in the bag in the form of a semi-fluid non-filterable substance. It was further observed that if any pressure is applied, however slight, water passes out with the oil, the amount of water being proportionate to the pressure. This is explained by the fact that without pressure the fatty matter is expelled through differences in density, the water remaining fixed to the solid particles forming a semi-fluid mass. But if pressure be applied, this adhesion of the water to the solid particles is neutralized.

The author has endeavored to apply these ideas in practice, and claims to have succeeded at least on a small scale; and notwithstanding the rough and ready methods employed he was able to obtain a yield of 18 per cent olive oil, calculated on the total weight of the olives, as compared with the yield of 12.6 per cent by the ordinary method. The advantages claimed for the new process are: (1) simplified mechanical means of low cost, (2) reduced labor cost, (3) production of perfectly pure filtered oil of uniform quality, and having all the qualities present in the original raw material, (4) high yield. It is hoped to publish further details. Meanwhile the cost of the experimental work of the last two years has been borne by the Ministry of National Economy and the Societa Nazionale degli Olivicoltori.—*The Chemical Age.*

DIGESTIBILITY OF HYDROGENATED FATS

A few years ago the United States Department of Agriculture made a study of the digestibility of some blended hydrogenated fats. Before that it had made similar studies on some fifty other fats and oils. These hydrogenated fats were found to be just as digestible as natural fats of corresponding melting points. Copies of the bulletin reporting this research on hydrogenated fats are still being distributed free. Requests should be addressed to the Office of Publications, United States Department of Agriculture, Washington, D. C., for Department Bulletin 1033, "Digestibility of cod-liver, Java almond, tea-seed, and watermelon seed oils, deer fat, and some blended hydrogenated fats."

STATISTICS OF OILS AND FATS

The Department of Commerce announces that the factory production of fats and oils (exclusive of refined oils and derivatives) during the three-month period ended September 30, 1926, was as follows: Vegetable oils, 445,150,318 pounds; fish oils, 39,777,179 pounds; animal fats, 498,716,225 pounds; and grease, 91,512,361 pounds; a total of 1,075,156,083 pounds. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 374,591,626 pounds, appears for lard. Next in order is linseed oil with 174,056,852 pounds; cottonseed oil with 165,704,813 pounds; tallow with 121,883,075 pounds; cocoanut oil with 62,980,899 pounds and corn oil with 30,770,307 pounds.

The production of refined oils during the period was as follows: Cottonseed, 109,968,513 pounds; cocoanut, 60,491,260 pounds; peanut, 2,659,457 pounds; corn, 23,092,079 pounds; soy-bean, 4,309,330 pounds; and palm-kernel, 173,350 pounds. The quantity of crude oil used in the production of each of these refined oils is included in the figures of crude consumed.

The data for the factory production, factory consumption, imports, exports, and factory and warehouse stocks of fats and oils and for the raw materials used in the production of vegetable oils for the three-month period appear in the following statements:

Production, Consumption, and Stocks of Fats and Oils

(In some cases, where products were made by a continuous process, the intermediate products were not reported.)

Kind	Factory operations for the quarter ended Sept. 30, 1926		Factory and Warehouse stocks
	Production (Pounds)	Consumption (Pounds)	Sept. 30, 1926 (Pounds)
VEGETABLE OILS:[1]			
Cottonseed, crude	165,704,813	123,044,429	58,158,232
Cottonseed, refined	109,968,513	211,755,720	64,567,610
Peanut, virgin and crude	1,005,741	3,207,989	4,864,555
Peanut, refined	2,659,457	2,261,932	1,363,852
Coconut, or copra, crude	62,980,899	117,049,960	66,972,916
Coconut, or copra, refined	60,491,260	52,245,161	11,880,901
Corn, crude	30,770,307	29,294,338	9,324,854
Corn, refined	23,092,079	8,285,636	8,523,839
Soy-bean, crude	46,445	7,422,448	7,805,514
Soy-bean, refined	4,309,330	5,750,521	2,087,407
Olive, edible	.....	1,103,712	5,689,474
Olive, inedible	.....	1,847,202	2,574,430
Sulphur oil, or olive foots	.....	8,979,642	11,124,637
Palm-kernel, crude	.....	15,010,912	5,067,009
Palm-kernel, refined	173,350	206,205	35,552
Rapeseed	10,120	5,447,080	6,834,203
Linseed	174,056,852	106,144,404	107,212,865
Chinese wood or tung	.....	21,305,328	17,206,063
Chinese vegetable tallow	.....	486,145	1,303,320
Castor	10,384,550	4,464,535	6,478,926
Palm	.....	33,776,768	24,439,898
All other	190,591	2,420,622	6,575,922

FISH OILS:[1]			
Cod and cod-liver	297,705	3,571,823	5,535,885
Menhaden	13,140,922	8,330,891	14,634,732
Whale	7,177,462	21,397,761	37,536,554
Herring, including sardines	17,415,802	7,104,478	23,491,801
Sperm	454,320	214,821	1,407,293
All other, (including marine animal)	1,290,968	390,372	4,032,531
ANIMAL FATS:			
Lard, neutral	8,101,056	4,826,170	4,834,788
Lard, other edible	366,490,570	3,305,895	88,962,513
Tallow, edible	15,874,243	12,837,094	4,499,739
Tallow, inedible	106,008,832	137,784,024	80,465,781
Neat's-foot oil	2,241,524	1,515,123	1,806,473
GREASES:			
White	16,602,884	6,316,702	6,848,400
Yellow	15,964,705	16,899,756	8,975,080
Brown	11,599,600	7,068,121	6,409,004
Bone	6,811,741	384,198	3,091,186
Tankage	11,952,080	688,401	5,823,102
Garbage or house	20,688,186	26,320,340	10,722,552
Wool	1,362,656	1,398,204	2,041,686
Recovered	4,004,631	2,701,867	1,707,666
All other	2,525,878	890,147	3,033,835
OTHER PRODUCTS:			
Lard compounds and other lard substitutes	242,371,937	62,282	18,127,501
Hydrogenated oils	101,148,242	96,485,748	7,099,317
Stearin, vegetable	1,301,792	2,819,419	1,207,641
Stearin, animal, edible	18,861,668	14,939,804	3,498,942
Stearin, animal, inedible	4,628,462	4,641,859	2,711,960
Oleo oil	38,846,989	11,630,719	14,180,425
Lard oil	5,446,117	4,787,738	4,806,926
Tallow oil	4,129,798	2,383,970	2,542,697
Fatty acids	40,648,130	47,350,934	6,084,945
Fatty acids, distilled	18,292,740	18,796,990	5,065,181
Red oil	12,528,104	5,493,079	6,794,496
Stearic acid	8,125,139	2,780,455	3,482,475
Glycerin, crude 80% basis	28,620,085	33,810,621	9,923,566
Glycerin, dynamite	12,504,974	8,251,820	11,160,555
Glycerin, chemically pure	15,653,254	1,305,818	5,764,831
Cottonseed foots, 50% basis	31,637,215	29,660,249	42,643,749
Cottonseed foots, distilled	35,227,897	33,843,002	4,872,492
Other vegetable oil foots	13,652,817	14,028,681	2,792,221
Other vegetable oil foots distilled	423,210	434,498	556,218
Acidulated soap stock	9,276,233	22,996,849	31,356,180
Miscellaneous soap stock	918,826	986,321	200,425

[1]The data of oils produced, consumed and on hand by fish oil producers and fish canners were collected by the Bureau of Fisheries.

Exports of Foreign Fats and Oils, Quarter Ended September 30, 1926

Kind	Pounds	Kind	Pounds
Beef and hog fats	288,766	Olive oil, edible	17,014
Fish oils	3,970	Palm & palm-kernel oil	463,088
Other animal oils, fats and greases	78,889	Peanut oil	8,426
Chinese wood oil or nut oil	1,480,863	Other vegetable oils	223,023
Coconut oil	534,688	Vegetable wax	114,441

Imports of Oil Seeds Quarter Ended Sept. 30, 1926

Kind	Tons	Kind	Tons
Cottonseed	1,926	Poppy seed	192
Castor beans	11,657	Perilla and sesame seed	306
Copra	65,016	Other oil seeds	2,467
Flaxseed	117,360		

Imports of Foreign Fats and Oils, Quarter Ended September 30, 1926

Kind	Pounds	Kind	Pounds
Whale oil	13,562,212	Palm-kernel oil	8,403,300
Cod & cod-liver	8,466,728	Peanut oil	5,751,039
Other fish oils	5,194,140	Rape oil	6,686,445
Beef and hog fats	1,553,560	Linseed oil	348,435
Wool grease	1,954,268	Sesame oil	3,649,438
Grease & oils, n.e.s. (value)	167,709	Soy-bean oil	11,403,239
Chinese wood oil or nut oil	26,039,034	Vegetable tallow	1,326,657
Coconut oil	59,614,408	Vegetable wax	1,491,959
Olive oil, edible	21,689,079	Other vegetable oils	11,409,061
Sulphur oil, or olive foots	12,912,209	Glycerin, crude	9,859,801
Olive oil, denatured	1,498,940	Glycerin, refined	3,931,210
Palm oil	28,854,657		

Exports of Domestic Fats and Oils, Quarter Ended September 30, 1926

Kind	Pounds	Kind	Pounds
Oleo oil	23,095,958	Stearic acid	226,893
Neat's-foot oil	277,638	Other animal greases, oils and fats	18,276,611
Other animal oils	90,783	Coconut oil	4,697,778
Fish oils	224,925	Cottonseed oil, crude	855,939
Oleo stock	2,810,561	Cottonseed oil, refined	905,639
Tallow	2,927,749	Linseed oil	1,083,773
Lard	161,723,481	Soy-bean oil	495,766
Lard, neutral	3,733,973	Corn oil	184,095
Lard compound, containing animal fats	1,257,073	Vegetable oil lard compound	1,484,237
Oleo and lard stearin	1,721,265	Vegetable soap stock	3,679,268
Grease stearin	655,299	Other vebetable oils and fats	2,015,767
Oleic acid, or red oil	376,353	Glycerin	216,694

Raw Materials Used in the Manufacture of Vegetable Oils

Tons of 2,000 pounds

Kind	Consumed June 30 to Sept. 30	On hand Sept. 30	Kind	Consumed June 30 to Sept. 30	On hand Sept. 30
Cottonseed	577,981	39,240	Corn germs	55,972	551
Peanuts, hulled	1,063	1,162	Flaxseed	266,195	70,296
Peanuts, in the hull	600	210	Castor beans	12,006	5,097
Copra	48,912	30,185	Mustard seed	377	828
Coconuts and skins	960	231	Soya-beans	179	5
Rape seed	22	...	Other kinds	295	318

Domestic Exports of Oleo Oil, Tallow, Oleic Acid or Red Oil, and Other Animal Greases, Oils and Fats, N. E. S., During September

Countries	Oleo oil Pounds	Tallow Pounds	Oleic acid or red oil Pounds	Other animal greases, oils and fats, n.e.s. Pounds
Belgium	239,616	.....	.....	280,924
Den. and Faroe Is.	394,718	.....	.....	.....
Finland	6,936	.....	.....	.....
France	.....	.....	.....	37,644
Germany	3,167,609	.....	10,899	13,490
Greece	153,617	.....	.....	.....
Irish Free State	72,910	.....	.....	.....
Italy	81,326	.....	.....	.....
Latvia	.....	.....	.....	89,834
Netherlands	2,664,344	.....	.....	2,928,140
Norway	593,945	.....	.....	.....
Sweden	218,578	.....	.....	.....
United Kingdom	1,522,374	533,878	.....	101,434
Canada	.....	1,522	37,514	1,232,111
Costa Rica	.....	.....	.....	6,189
Guatemala	.....	76,486	.....	21,117
Honduras	.....	7,709	.....	.....
Nicaragua	.....	8,000	.....	29,989
Panama	.....	468	.....	.....
Salvador	.....	758	.....	.....
Mexico	2,999	271,226	38,984	271,131
Newfoundland & Labrador	268,677	.....	.....	1,951
Jamaica	79	250	.....	375
Trinidad & Tobago	.....	.....	.....	1,136
Other B. W. Indies	200	.....	.....	.....
Cuba	45,949	60,583	.....	976,719
Dom. Republic	.....	66,642	.....	.....
Hatian Republic	.....	600	.....	.....
Virgin Is. of U. S.	500	455	.....	.....
Brazil	28,485	.....	.....	.....
Colombia	.....	61,878	.....	3,434
B. Guiana	.....	425	.....	.....
D. Guiana	.....	2,621	.....	.....
Peru	.....	6,600	.....	1,862
Venezuela	.....	2,019	.....	2,109
China	.....	.....	.....	12,178
Japan, including Chosen	4,000	.....	.....	.....
Philippine Islands	.....	.....	.....	4,203
Australia	.....	.....	.....	7,870
Quantity	9,466,862	1,122,120	87,397	6,023,840
Total Value	1,128,684	100,133	8,316	572,148

Imports of Olives, Coconut Meat and Coconut Oil, Peanuts and Peanut Oil, and Olive Oil, Edible, Into the United States During August

Countries	Olives in brine		Coconut meat, desiccated, shredded cut or similarly prepared		Copra		Coconut oil	
	Gallons	Dollars	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
D. & F. Is.	3,920	3,151	.....	.....	.....	.....	.....	.....
France	27	101	.....	.....	.....	.....	.....	.....
Greece	3,358	1,749	.....	.....	.....	.....	.....	.....
Italy	26,427	7,642	.....	.....	.....	.....	.....	.....
Portugal	1,104	787	.....	.....	.....	.....	.....	.....
Spain	305,883	268,241	.....	.....	.....	.....	.....	.....
Canada	....	.....	.....	.....	30,196	1,736	.....	.....
B. Honduras	....	.....	.....	.....	400,721	20,036	.....	.....
Nicaragua	....	.....	.....	.....	1,600	72	.....	.....
Panama	....	.....	.....	.....	65,710	3,405	.....	.....
Jamaica	....	.....	.....	.....	179,664	4,652	.....	.....
Peru	4,155	3,781	.....	.....	.....	.....	.....	.....
Br. Malaya	....	.....	.....	.....	12,633,222	714,584	.....	.....
Ceylon	....	.....	1,699,655	160,502	.....	.....	.....	.....
China	104	263	.....	.....	.....	.....	.....	.....
Hongkong	140	120	.....	.....	.....	.....	.....	.....
Philip. Is.	....	.....	2,714,937	236,077	18,013,748	937,546	20,949,509	1,916,932
Br. Oceania	....	.....	.....	.....	280,776	15,811	.....	.....
Fr. Oceania	....	.....	.....	.....	2,828,327	148,683	.....	.....
Total	345,118	285,835	4,414,592	396,579	34,433,964	1,846,525	20,949,509	1,916,923

PEANUTS

Countries	Shelled		Not shelled		Peanut oil	
	Pounds	Dollars	Pounds	Dollars	Pounds	Dollars
Germany	52,537	4,245	....	....	....	....
Netherlands	....	....	....	....	1,932	237
China	983,437	46,781	150,000	5,930	2,617,998	253,445
Hongkong	....	....	905	116	120,203	14,799
Japan, including Chosen	977	46	28,640	1,551	....	....
Kwangtung	....	....	.....	....	57,000	5,633
Total	1,036,951	51,072	179,545	7,597	2,797,133	274,114

OLIVE OIL, EDIBLE

Countries	In packages weighing less than 40 pounds		Other	
	Pounds	Dollars	Pounds	Dollars
France	119,330	18,043	133,679	20,648
Greece	132	15	28,312	4,263
Italy	4,620,115	743,586	765,472	136,737
Portugal	14,446	2,567	.....	.....
Spain	253,777	43,676	982,604	169,715
Canada	24	9	.....	.....
Brazil	33,625	6,359	.....	.....
Japan, inc. Chos	59,197	9,077	16,572	2,832
Alg. & Tun.	.....	.....	54,694	7,097
Total	5,100,646	823,332	1,981,333	341,292

Domestic Exports of Lard Compounds and Oleomargarine from the United States During September

Countries	Lard compounds containing animal fats Pounds	Dollars	Oleomargarine of animal or vegetable fats Pounds	Dollars	Vegetable oil lard compounds Pounds	Dollars
Germany	....	....	....	....	30	6
Greece	....	....	....	....	600	96
Italy	....	....	....	....	2,536	433
Netherlands	44,126	4,825	40,135	4,118	14,043	1,298
Norway	....	....	....	....	6,875	1,000
United Kingdom	35,700	3,855	....	....	42,529	6,751
Canada	4,458	568	1,120	235	9,185	1,594
British Honduras	8,716	1,382	100	21	5,156	817
Costa Rica	108	23	....	....	....	....
Guatemala	180	30	....	....	10,953	2,020
Honduras	....	....	....	....	3,236	591
Nicaragua	2,184	337	....	....	1,109	209
Panama	20,190	3,243	39,050	8,305	10,105	2,132
Mexico	23,839	3,498	2,000	402	195,193	21,067
Newfoundland and Labrador	11,097	1,639	2,500	425	11,157	1,927
Bermuda	600	116	180	36	1,685	298
Jamaica	1,393	231	145	20	11,472	2,045
Trinidad and Tobago	3,600	540	....	....	....	....
Other British West Indies	17,750	2,732	13,426	2,623	27,303	4,294
Cuba	134,108	20,472	650	130	57,207	8,863
Dominican Republic	11,100	1,610	....	....	360	80
Dutch West Indies	10,898	1,652	....	....	860	150
Haitian Republic	58,700	11,032	....	....	32,340	5,755
Virgin Islands of U. S.	27,081	4,264	5,400	1,006	....	....
Argentina	....	....	....	....	4,400	814
Chile	39,600	6,287	....	....	11,262	1,949
Colombia	2,500	523	....	....	970	186
Ecuador	....	....	....	....	79,255	12,893
Dutch Guiana	250	65	....	....	....	....
Peru	10,000	1,500	....	....	....	....
Venezuela	....	....	....	....	432	96
China	....	....	....	....	7,284	1,704
Hongkong	....	....	....	....	1,380	319
Japan, including Chosen	305	29	....	....	12,617	2,133
Persia	....	....	....	....	60	10
Philippine Islands	5,000	800	....	....	52,629	10,966
Siam	....	....	....	....	360	80
Syria	....	....	....	....	72	15
British Oceania	....	....	....	....	96	27
French Oceania	225	37	....	....	684	167
New Zealand	....	....	....	....	6,384	1,085
British South Africa	600	118	....	....	813	130
British West Africa	3,612	750	....	....	600	125
Canary Islands	600	90	....	....	....	....
Total	478,520	72,248	104,706	17,321	623,232	94,125

Shipments from the United States to Non-Contiguous Territories

	Lard compounds containing animal fats Pounds	Dollars
Alaska	35,840	5,930
Hawaii	65,227	10,922
Porto Rico	2,361	355

Domestic Exports of Vegetable Oils, Expressed, from the United States During September

Countries	Cottonseed Oil Crude Pounds	Cottonseed Oil Refined Pounds	Corn Oil Pounds	Cocoa Butter Pounds	Cocoanut Oil Pounds	Linseed Oil Pounds	Soy Bean Oil Pounds
A. and Madeira Islands	....	....	....	....	....	375	....
Germany	....	2,026	....	....	....	....	....
Canada	234,745	155,573	828	60,785	468,165	18,878	379
British Honduras	....	133	....	....	....	....	....
Costa Rica	....	1,043	475	....	10,360	900	16,405
Guatemala	....	3,296	....	....	....	450	4,500
Honduras	....	2,655	250	5	....	9,413	....
Nicaragua	....	5,279	....	....	32,117	1,077	....
Panama	....	57,326	....	192	....	416	7,500
Salvador	....	5,994	720	....	1,100	510	....
Mexico	120,200	64,176	660	208	854,280	17,450	7,500
Newfoundland & Lab.	....	....	....	....	....	7,781	....
Bermuda	....	85	....	....	....	....	....
Jamaica	....	....	....	....	....	400	....
Other B. W. Indies	....	246	....	....	200	160	96
Cuba	....	8,351	1,954	403	10,697	33,200	74,925
Dom. Republic	....	7,190	....	130	.. .	6,382	34,150
O. W. Indies	....	2,475	....	....	....	....	375
Haitian Republic	....	5,433	965	....	502	10,793	1,145
Virgin Is. of U. S.	....	1,217	150	....	....	....	....
Brazil	....	....	1,000	....	....	....	....
Chile	7,790	2,423	....	....	....	....	....
Colombia	....	12,717	160	496	7,934	23,690	12,210
D. Guiana	....	375	....	....	....	9,833	....
Peru	....	90	....	894	....	5,883	....
Venezuela	....	733	....	....	....	8,076	....
British India	....	....	450	....	....	....	1,650
China	....	5,090	....	360	406	1,566	....
Hongkong	....	1,470	....	....	....	....	....
Japan Inc. Chosen	....	47,733	....	....	16,272	....	....
Philippine Islands	....	5,977	....	60	....	....	....
Siam	....	....	....	....	....	100	....
Russia in A	....	....	....	....	....	228	....
Australia	....	92	....	....	....	....	72
Br. Oceania	....	....	....	....	....	225	....
Fr. Oceania	....	....	....	....	....	1,905	....
New Zealand	....	....	....	....	55,430	....	....
British S. Africa	....	2,520	28,620	....	....	....	118,859
British W. Africa	....	....	....	....	....	200	....
Liberia	....	....	....	....	....	78	....
Portuguese E. A	....	....	....	....	....	....	22,785
Other Pt. Africa	....	....	....	....	....	184	....
Quantities	362,735	401,718	36,232	63,533	1,457,459	160,153	302,551
Dollars	27,482	55,445	4,846	21,160	133,683	20,215	38,984

Shipments from the United States to Non-Contiguous Territories

OILS EXPRESSED

	Cottonseed		Linseed	
	Pounds	Dollars	Pounds	Dollars
Alaska	4,500	592	6,279	768
Hawaii	44,842	9,392	22,625	3,066
Porto Rico	30,219	4,284	57,186	6,814

ABSTRACTS

Kapok Oil. (Bull. Imp. Inst. 1926, **24**, 18-36). Kapok seed from Travancore, Federated Malay States, Gold Coast and Zanzibar varied in its oil content from 27.4 per cent on the dry seed for Travancore to 21.6 per cent for F. M. S. The oils had the following characteristics: Sp. gr. at 15°C. (T) 0.9217, (G. C.) 0.9226, (Z) 0.914; acid value, (T) 30.9, (F. M. S.) 54.1, and 61.10 (G. C.) 6.1, (Z) 26.0; saponification value, (T) 192.2, (G. C.) 193.5, (Z) 194.1; iodine value, Hubl. 17 hours, (T) 90.4, (G. C.) 89.6, (Z) 101.5; and for Travancore oil unsaponifiable matter, 1.2 per cent, $n_D^{40°}$ 1. 463; and "titer," 29.8°C. The meal from Travancore seed closely resembled commercial kapok cake but contained proportionately more (about 4 per cent) protein.—D. G. H.

Unsaturated Fatty Acids Associated with Corn Starch. Taylor and L. Lehrman. (J. Amer. Chem. Soc. 1926, **48**, 1739-1743). Corn starch (a-amylose), completely freed from extraneous fat by means of ordinary solvents, yields, on hydrolysis with acids, 0.5 to 0.6 per cent of fatty acids, which consist of approximately 24 per cent of palmitic, 40 per cent of oleic, and 36 per cent of linolic acid.—T. H. P.

Influence of Fatty Acids on Bomer's Melting-Point Method. F. J. F. Muschter and R. Smid. (Chem. Weekblad, 1926, **23**, 284-285) Bomer's differential melting-point method (Analyst, 1913, **38**, 204, 214; 1914, **39**, 84, 171) gives fallacious results if applied to lards containing free fatty acids (in excess, 0.3 per cent of free oleic acid). For instance, a neutral fat showing a Bomer value of 70, gave a value of 71.5 when mixed with 2.5 per cent of stearic acid, and of 72.0 when mixed with 5 per cent of palmitic acid. Again, a grease with a Bomer value of over 71 gave, after removal of free fatty acids, a value below 71, and was therefore adulterated.

Free Acids of Edible Oils (Olive Oil). A. Ceriotti and A. Sanguinetti (Rev. Fac. Cien. Quim., 1925, **3**, 65-75). Data are given for the free acid content, expressed as oleic acid, of samples of olive oil from different countries. Since free acidity greater than 1.5 per cent is only shown in a few cases, it is recommended that this figure should be adopted as the legal maximum.—G. W. Robinson.

Determination of the Titer of Tallow. J. Davidsohn (Z. Deuts. Oel-u. Fett-Ind., 1926, **46**, 353-354).—The effect of varying the conditions in the Dalican method of determining the titer (solidif. point of insoluble fatty acids) of tallow was determined. A particular tallow gave the following results: (a) without stirring, titer 43.50° and 43.40°; (b) stirring three times to the right and three times to the left after solidification started, 43.48° and 43.40°; (c) stirring from the start until solidification commenced, 44.20°. It is recommended to omit the use of alcoholic potash for the saponification, which can be effected by heating the fat and aqueous alkali on a water bath, and then keeping the mixture at 100-105° for 1½ hrs. This is much safer than the alcoholic alkali saponification, as there is no risk of ester formation from traces of alcohl left in the mixture. In the case of the above tallow, when the alcohol was not completely removed after saponification with alcoholic alkali a titer of (a) 39.90°; (b) 40.82°, and (c) 40.75° under the conditions mentioned was observed. It is stated that the latent heat fusion of the fatty acids decreases with repeated reheating and finally neither rise nor stationary point is observed in the test; in such cases a fresh sample must be taken.

New Fatty Acids in Shark Liver Oil. Fatty Acids of Shark and Ray Liver Oils. I. M. Tsujimoto (z. Deuts. Oel-u. Fett-Ind., 1926, **46**, 285-388)—The fatty acids from two species of red shark were examined, and two new fatty acids were isolated, viz., selachoceric acid, $C_{21}H_{43}O_2$, white crystals, m.p. 78°, and selacholeic acid, $C_{24}H_{46}O_2$, white crystals, m.p. 42.5—43°. The latter when hydrogenated gave a saturated acid isoselachoceric acid, m.p. about 82°. By treating selacholeic acid with nitrous acid, a stereoisomeride, selachelaidic acid, m.p. 60.5°, was produced.

MAKING SHARK LIVER OIL

The Alaskan Glacier Sea Food company, Petersburg, Alaska, has been experimenting with the production of shark liver oil with the idea of developing a new line of profit for the smaller halibut boats. These boats, says Earl N. Ohmer of this company, catch numbers of sharks in the course of halibut fishing, and it was felt that by opening a market for the livers they might have a source of income that would take care of part of their expenses. The method followed is to put the livers only in a vat and boil slowly with a steam coil submerged in the tank. One Petersburg boat owner has gone into shark fishing as a regular thing as a result of the experiment.

THE JOURNAL OF OIL AND FAT INDUSTRIES

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of Journal of Oil and Fat Industries, published monthly at New York, N. Y., for October 1, 1926

State of New York } ss.:
County of New York }

Before me, a Notary in and for the State and county aforesaid, personally appeared John T. Ogden, who, having been duly sworn according to law, deposes and says that he is the Editor of the Journal of Oil and Fat Industries, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Russell Palmer, 71 Columbia St., Seattle, Wash.; Editor, John T. Ogden, 220 West 42d St., New York City; Managing Editor, none; Business Manager, Russell Palmer, 71 Columbia St., Seattle, Wash.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. It not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Russell Palmer, 71 Columbia St., Seattle, Wash.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

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JOHN T. OGDEN,
Editor.

Sworn to and subscribed before me this 27th day of September, 1926.

(Seal.) Johanna E. Schult,
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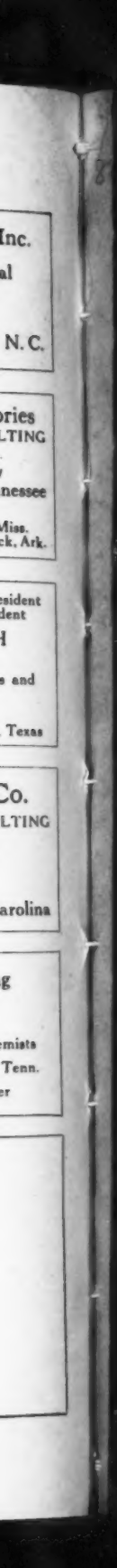
AMERICAN JOURNAL OF BOTANY
Devoted to All Branches of Botanical Science
Established 1914. Monthly except August and September. Official Publication of the Botanical Society of America.
Subscription $6 a year. Volumes 1-11 complete, $79 post free. Single numbers, 75 cents, post free; Prices of odd volumes on request. Foreign postage 40 cents.
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